-:- Achievements of the Cottonwoods and American Fork -:-

Big and Little Cottonwoods and American Fork, the trinity of mining districts which cover the west-southwesterly extension of the great mineral-bearing zone that nas made Park City famous, give more promise today of making a noise in the world than they have ever done since the palmy days of Alta. The Cottonwoods and American Fork canyons head nearly together, and each of them opens out into the Salt Lake valley, a few miles south of this city and, as a consequence, the mines which they contain are all practically in sight of the smelters which treat their ores.

Alta, the chief camp, is located near the head of the middle, or Little Cottonwood canyon. The geological structure of the formation there is, with varying modifications, illustrative of that which is found in the other two, and for that reason the reader's attention is called to the article elsewhere from the pen of Henry M. Crowther, the mining engineer, which deals with the geology, mineralizatlon and ore occurrence in Alta. While the article was written by Mr. Crowther on extremely short notice, and was solicited by The Herald just at a time when he was almost too busy to give it any attention, much will be found in it that should prove of great value to the men and companies operating in the districts which this short review covers. Mr. Crowther has had occasion to professionally give a great deal of attention to the formation of the Park City district, and through the operations of his own company (the Continental) at Alta and an intimate acquaintance with conditions in other properties of that camp, he has become sufficiently informed on the subjects of which he treats to make his utterances worth something to those less well informed.

Several years ago Mr. Crowther made a study of the Bingham camp and its geological characteristics. His findings were published by the Bingham Bulletin and, later, when the geological survey experts compiled their reports on the district, they found to coincide with Mr. Crowther's deductions. This fact will give added weight to his conclusions respecting the formation of the Alta camp, which he has come to know even more intimately than he did that of Bingham.

Alta to the Front.

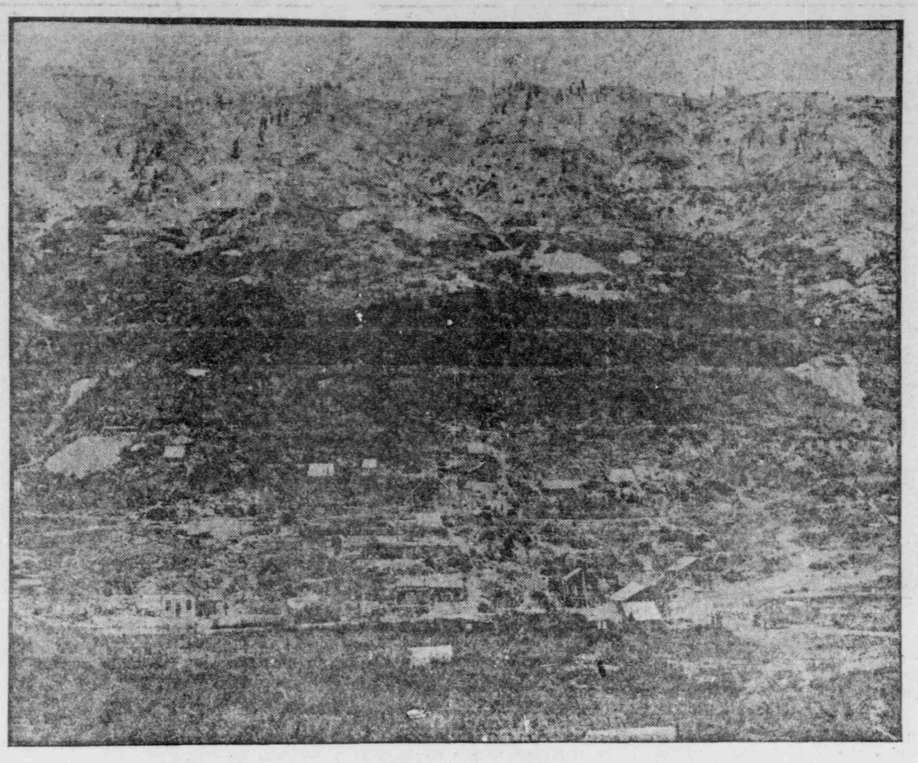
A great deal has happened during the year at Alta to give it a prestige in the mining world. Strong combinations of capital have been enlisted in the work of reopening some of the old mines, and in many portions of the district steady development has been progressing on new properties. Probably the most sensational of the camp's achievements has been the opening of tremendous bodies of rich sulphide ores in the lower levels of the Columbus Consolidated company's properties. These disclosures are bound to have a great bearing on the future of the camp, as they have settled once and for all the mooted question as to whether the ores go down to the deep there as they do at Park City. In addition to adding millions to the value of its mine through these developments, the management of the company has also perfected its milling plant, added greatly to its power plant's efficiency, provided additional storage bon capacity and erected one of the finest homes for its employes in the state. In the face of it all large additions have been made to the treasury reserve and the company's faces the new year prepared to begin the reimbursement of those who have backed the enterprise through the purchase of shares in the corporation and the payment of a good, stiff assessment or two. Manager Tony Jacobson has been sure of his footing from the very beginning and he has never for a moment swerved from his purpose to make a big bonanza of the ground. He has had, at times, to combat views held in opposition to his own, but there has always been a strong majority of the stockholders with him and he has gone ahead with a determination that no obstructionist should hold the property back. He has won out and the company and camp are indebted to him for the energy and nerve he has displayed in fighting the battle.

Continental Operations.

At the Continental company's properties a world of development work has been done during the year and tremendous quantities of ore has been blocked out in doing it. The company's mill has been kept running quite steadily and through the operation of this plant and the aerial tramway that spans the five miles of distance between there and the mine, Manager Henry M. Crowther has demonstrated that it is possible to make a fine profit in the handling of low-grade ores, ores which, a few years ago, could not have been touched under any condition. He is now planning to reach for much greater depth in the mine, enlarge the milling capacity of the plant at Tanner's flat and do other things that will inure to the lasting benefit and profit and the growth of the district.

At the Albion.

During the late fall Manager William Hatfield of the old Albion company's mines, reached the objective point in the long tunnel that was sent in to drain the property and acquire depth. He has succeeded in draining the old workings and is now taking out considerable high-grade ore. During the next month or two the lower tunnel and the upper workings will have been connected and then it will be possible to send every pound of ore out through the tunnel and permit of the opening of several new levels. The Albion will be in the list of dividend-payers during the coming twelve months, unless all signs fail.



General View of Alta.

Michigan Men Buy Ground.

Within the last few weeks a powerful Michigan syndicate has acquired the old City Rock mines and the intention is to properly equip them by spring and then begin operations on an extensive scale. This property has a record for having produced more than half a million and there is a tremendous tonnage of marketable ore now on the dumps and exposed in the mine workings. If the new owners show the same nerve and determination that has characterized operations at other properties in the district the City Rock group will be earning dividends again in a short time.

Development has been steadily going forward at the South Columbus and Alta-Quincy properties during the year and, while the main objective point in them has not yet been reached, everything seems to indicate that early spring will see a change in them of importance.

Pittsburg, Kennebec and Others.

The Pittsburg Consolidated has been handicapped in its operations during the season for lack of means to carry on the work in the manner that merits of the property deserve. Great bodies of lead-sliver ore, copper ore, and, in one of the veins, high-grade zinc ore, exist. The ground is so located, however, that it is hard to mine without driving a tunnel and getting under the ore bodies from a point where a road can be built and transportation down into thecanyon made easy. These things will come, for no such valuable ground can long be permitted to go undeveloped and mined.

The Kennebec company's property, under the management of W. J. Craig, has been steadily operated during the year and a new tunnel is now being driven to cut the ore bodies at a point in the ground. The management is not worrying at all over the future. It is simply sawing wood and making a mine. It will be heard from by and by and in a manner that will reflect credit on the camp and mean money to the company.

The Alta-Flagstaff company has been thoroughly financed during the year and the property is being equipped for a vigorous and telling campaign. New boarding and lodging houses have been erected and supplies to be used in the driving of the tunnel and doing other work have been put in and power has been secured from the Columbus company with which to keep the machine drills pounding away.

The Pioneer Consolidated company, which owns a fine block of ground close to the Pittsburg, has commenced the driving of a tunnel to open up the known ore-bearing channels in the ground at depth, and this work is being steadily prosecuted by contract and under the direction of Superintendent Arthur Murphy. A good mine should be opened at depth during the next twelve months.

There is every prospect that the camp of Alta will be connected by rail during the coming season, the idea being to extend the Rio Grande tracks up to Tanner's Flat and then reopen the narrow-gauge tram line for the remainder of the distance and operate it v th electric locomotives. Either this scheme or the utilization of the Continetnal aerial tramway will likely be adopted in the spring.

The Intermountain Power company is constructing its initial plant at or near the mouth of the Little Cottonwood canyon and during the coming year this company will be prepared to supply power to Alta, Big Cottonwood, American Fork and the valley below, as well. Following the installation of the Little Cottonwood plant, the performance will be repeated in Big Cottonwod, so that all three of the camps in this section will be able to get all the power they need without going to the expense of erecting individual plants

Alta's Side Partners.

No startling changes have been recorded in the operations being conducted in either Big Cottonwood or American Fork during the year. Uncle Jesse Knight, of Provo, is now in absolute control of the Great Western and Mountain Lake companies' properties, and in the former he is still pounding th long tunnel through to a connection with the ore bodies exposed in the old upper workings. For some time back the formation has been showing copper, and he expects during the present winter to be able to say that he has made a mine of the ground.

Colonel Nicholas Treweek, the head man in the Big Cottonwood Copper & Gold Mining company, has been too much absorbed in the affairs of the Wabash company during the past year to give the former much attention, but he is planning to et things under way there again in the near future.

The Woodlawn company has done some work and at one time during the season undertook a trial shipment of its zinc-lead ores. Results were not altogether satisfactory and matters have since been quiet.

The Old Evergreen company has done considerable work during the year and Manager H. G. McMillan is confident that one of these days they will make a big mine of the property.

The Maxfield company, a close corporation, at the head of which is Postmaster A. L. Thomas, has been producing steadily all through the year and operations are understood to have been more profitable than at any time in the past, and that is saying a great deal, as the ores shipped run very high in silver, lead, gold and copper.

Considerable work has been done or other properties in the district and some new mines are promised to result from the work going on during the coming year.

Unusual activity has characterized operations in American Fork but aside from the few shipments from the Wyoming, on Miller hill, there has not been much in the way of production to report. Telling work is being done at a number of properties, however, and the coming year should show a great change for the better in the district. American Fork needs money and men of nerve and determination behind it. When it gets these in the opinion of experts, it will be heard from in no uncertain manner.

ALTA, Its Geology, Ore Occurrence and Mineralization

By Henry M. Crowther

Alta camp or Little Cottonwood mining district, being at the dawn of a modern method era, and promising so well to attract world-wide attention as a famous mining camp, data concerning its geological history and economic relations to mineral industry in the light of modern deductions, are of great interest, especially in the fact that so little of a technical nature has been written on the district. Geologically speaking, the ore-bearing strata of Alta dates from the very foundation layers of the earth's crust and its main ore bodies are but little removed from the granite or basal formation, and, indeed, important ore occurrence exists both in and at granite contact with quartzite and limestone. The stratigraphy of Little Cottonwood canyon, from its mouth to Alta at the head of the gulch, is as regular as the leaves of a book, and presents a simple anti-clinal fold with a general north and south axis, greatly eroded both at apex and west limb. Practically no mining is done on the valley slopes of the Wasatch range, primarily because the limestone or ore-bearing strata is eroded almost entirely away to a great depth below the slopes of Great Salt Lake valley.

To reach the mining region of the range it is necessary to go up the narrow gorge of Little Cottonwood creek, passing through some six miles of apparently barren granite, which constitutes the core of the range structure. Just below Tanner's flat the first sedimentary rocks (the lower quartzites) are seen crowning the granite and dipping regularly toward the head of the canyon. Four miles above, or near Alta, the limestones that lie on the quartzites reach the bottom of the canyon, and thereafter the canyon, which here broadens to quite an extensive open flat, is entirely in limestone and upper quartize, and this series of strata constitutes the mining region.

The thickness of the total limestone strata, as exposed, is probably in the neighborhood of 2,600 feet, and is assumed to be of lower and upper carboniferous. The lower strata, or that which lies on the quartzite, is of a blue and white banded structure, and on this strata rests some hundreds of feet in thickness of Columbus quartzite, on which is several hundreds of feet in thickness of upper limestone. The upper lime stratas are also interlaid with black and shaley limes.

This upper mass of limestone is a regular series of distinct layers, the thickness of the separate bands varying from two feet to dozens of feet, and the whole sloping from 34 to 40 degrees into the north side of the canyon, or to the northeast.

The limestone is traversed by numerous diorite dykes, and is extensively fissured, and it is these dyke contacts in some few instances, but mostly the fissured region of sedimentary strata, that bear the ore bodies. At the extreme head of the main gulch there is an intrusion or denuded laccolite of granite and granodiorite of considerable extent, in contact with limestone.

The Columbus quartzite referred to corresponds in geological age to the Ontario quartzite of Park City, while the Flagstaff and Continental limestones bear a similar relation to the Silver King limestone of the same camp. The same system of diorite dykes extend from Park City to Alta.

The erosion at Park City in the vicinity of the mines has been deeper, stratigraphically considered, than at Alta, and the strata that nas been mined in at Alta represents that which is eroded at Park City. Accordingly, broadly speaking, mining at Alta has only been prosecuted to barely the same stratigraphic depth as the outcrops of ore deposits at Park City. The distance separating the main ore regions of Alta and Park City is but 25,000 feet, hence the relation of these camps to each other is very marked.

Topographically considered, the most elevated mining at Alta begins at a horizon of 10,400 feet above sea level, at the Continental company's upper workings, and extends in this property to 9,500 feet, of lower tunnel, while the deepest workings at camp are at the Columbus Consolidated, beginning at an altitude of about 8,900 feet and extending down to 8,600 feet above sea level; while the deepest mining at Park City (the Daly-West and Ontario) begins at about 8,500 feet elevation and extends down to about 6,000 feet above sea level.

Henry M. Crowther.

This Alta mining has proceeded no deeper than 400 feet higher than the most elevated outcrops (Daly-West) in Park City. This feature is further emphasized in the fact that all Alta mining is tunnel development, while at Park City it is mostly shaft development.

This matter is discussed simply as an interesting comparison. the field of which requires too much data by actual survey and study by geological comparison of strata for the scope of a short article. But it suggests that United States geological survey work might well include both Park City and Alta districts as a geological whole.

Ore Occurrence.

The principal ore bodies of Alta occur in limestone, and mostly at the junction of fissures, but there are also contact or strata deposits that seem independent of fissure influence, though such ore is of lower grade than that in the vicinity of fissures and dykes.

The porphyry dykes or masses or eruptive rocks of the district are not of themselves of value for mineral, as some in Bingham. nor does the ore often follow the dykes, that is, the main ore bodies are not on walls of dykes at contact of sedimentaries. The principal intrusive dyks cut the limestone beds at nearly right angles both in dip and strike. The fissure system has about the same general strike and dip as the dykes, or northeast and southwest, with 65 to 80 degrees dip to the northwest, or the same as at Park City, of which district Alta is a well defined continuation. The fissures in most instances bear ore only at the junction of certain limestone strata, while the limestone is mineralized for a distance of usually two to one hundred feet from the fissure, according to whether the fissure is strong and well defined or weak and pinched at the point of conjunction. These fissures are very persistent and where penetrating non-ore-making strata hold their course and are strongly marked, even if very narrow.

At points where fissures cut the ore-making channels or favorable lime stratas the ore body at such places often makes for a considerable distance upwards (rarely downwards) in the fissure above the main ore bearing lime, and should this occur at a point where a flat ore shoot or that which makes in the limestone beds, is not strong, the inclination of the miner has been to follow the fissure ore which sooner or later pinches down, and so the main ore channel is often lost, as has been the case in several of Alta's most famous producers.

However, had these fissures been followed farther up or down to their conjunction with over or underlying ore-making lime strata, new ore shoots would no doubt have been developed, but, as of more immediate concern, the original strata of flat lying lime should have been followed down on its dip at conjunction of fissure, depending on opening up a new shoot a short distance on. To sum up the situation into a general statement, the principal ore channels of Alta limestone occupy mainly the bedded limestone strata and not to any extent the fissures except at conjunction with certain limestone strata. All the limestone is not favorable to ore bearing, but only an occasional layer or strata, which no doubt are those of most carbonaceous and calcereous composition, while the intervening layers being more silicious are not so favorable to chemical dissolution by ore deposition and replacement. Accordingly, as the more carbonaceous or calcereous limestone is thick or thin, so is the accompanying ore channel large or small.

Early-day mining in the camp resulted in several main ore channels being lost and some unwisely spent effort to relocate them, but as a rule but little has been done except the extraction of the main bonanza ore bodies with practically no intelligent new exploration, until recently. There has been a notable absence of faulting in the district, and this being so, it would seem that ore channels could not easily be lost, but practically all early-day mining of the camp has been in oxidized zones at shallow depth, and such ore is not so well marked as sulphides and is thus more difficult to follow.

The recent rich disclosures of ore in the water level development of the Columbus Consolidated, is the first deep mining to begin in the camp, and this exploration is ample evidence of great depth of Alta ore occurrence as well as the increased value of the ore below the oxidized zone. As stated, the strictly contact ledges that bear ore apparently irrespective of fissure influence are not so high-grade, but there are several such ledges from four to seven feet thick carrying 2 per cent to 3½ per cent copper in sulphide form with $1.00 to $2.50 in gold and silver, but these veins have not been developed as yet.

Brecciated country rock, with ore filling, forms a considerable proportion of the camp's milling ores, and such bodies are often of great extent.

Important contact ore deposits exist in the Columbus between quartzite and limestone, also in the Continental at contact of diorite and limestone, but this ore is a flat shoot following certain limestone strata irrespective of the dip of an igneous dyke which is nearly vertical.

The ore bodies of Alta are large and extensive, being often sixty feet wide, and the main ore shoots are generally exceptionally continous on dip. Practically no sulphide ore mining has been done in the camp, largely for the reason that mining development has been comparatively shallow and water level in veins favorable to sulphide occurrence has not been reached except in the case of the Columbus.

District's Mineralization.

Practically all the ore mined in early days in the upper limestone was completely oxidized, containing less than one unit of sulphur, and even that small amount in the form of sulphates, though kidneys and boulders of sulphides occasionally occurred where oxidation of original sulphides had not been complete.

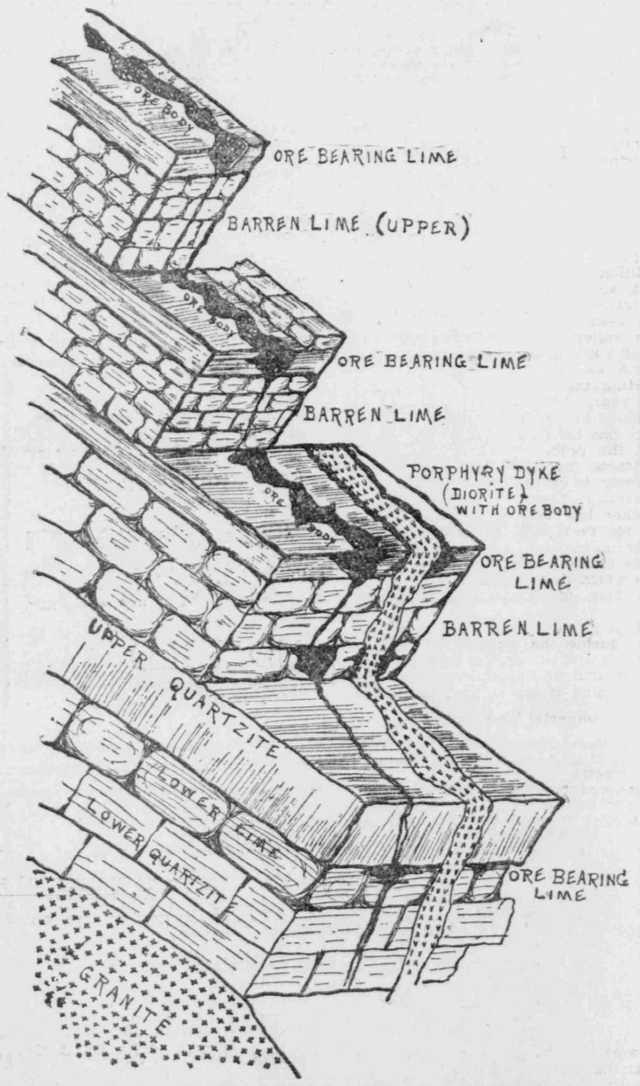
Sulphides occur in and adjacent to the Columbus quartzite, near the surface, and due, no doubt, to the acid character of such rock. While oxidization of ores in most limestone remote from the quartzite is complete to a depth of over 800 feet, which is about the greatest vertical depth yet reached by mines of the district. The Albion mine has penetrated the sulphide zone, so has the Columbus, but the Continental-Alta is still in the oxidized zone at nearly 900 feet vertical depth, as is the Flagstaff, Emma, and City Rocks.

No doubt the deep oxidization is due primarily to the preponderating presence of alkaline ore bearing rocks which are the limestones, while in the acid rocks or the granite and quartzite bear sulphides, practically from the surface.

The contact-fissure ore bodies are of great size in some instances, being sixty to eighty feet wide and forty feet thick, which dimensions refer to the width of mineralization at intersection of fissure, and thickness, to the depth of ore bearing strata.

The contact ledge veins are usually from four to eight feet thick and seem to extend throughout the district following certain strata of which the vein matter is composed.

Such a vein as this is the Continental-City Rocks granite-lime contact, which is a vein four to ten feet wide and assaying 1½ to 2 per cent copper, .02 to .03 ounces gold, 2 ounces silver, 54 per cent iron, 12 per cent insoluble, no zinc, 2.3 aluminum oxide, 6 per cent sulphur. Three-fourths of the 54 per cent iron is magnetic, and by passing the crushed ore over a magnet, a non-magnetic product is obtained with about 3 into 1 concentration, bringing values up to .06 gold, 53 silver, and 5 per cent copper in sulphide form, which product may then be further concentrated by the ordinary wet method. The magnetic separation is best done in water and entails practically no extra expense of treatment over ordinary wet crushing and concentration.



Idealized Section of Alta Geology and Ore Occurrence, Showing Fissures Bearing Ore, mostly at Intersection of Certain Succeeding or Alternating Calcareous and Carbonaceous Strata of Limestone. Also Showing Dyke Contact Mineralization.

Alta's lead ores rarely contain under 1 per cent copper and sometimes as high as 5 per cent copper in ores that lead predominates in. Ores containing over 5 per cent copper may be considered copper ores, but these rarely contain less than 2 per cent lead. Still, many ores run very high in both lead and copper. The sliver values in average oxidized ore range from ½ to 1 ounce to each unit of lead and copper and .03 to .06 ounces gold. There are also important deposits of copper sulphide ores containing neither lead no zinc, but these are practically undeveloped.

The sulphide ores run from 20 to 10 ounces of silver, and $1 to $6 gold. The richest gold values occur nearest to o in the quartzite.

Molybdemum, vanadium and tungsten occur in considerable quantitie in the camp, as wulfenite, vanadna of lead and tungstate of iron. The fir two are very important as lead ores.

There are considerable surface d posits of manganese, containing up .0 per cent, but they are not of v for other metals, being very low in silver. No attempt has yet been made to utilize the manganese. Zinc is not a detrimental smelting feature in the camp's ores, which rarely carry over 7 per cent, though heavy zinc ore exists in Big Cottonwood district.

Alta is distinctly a copper camp, though it will necessarily produce heavily in associated lead. Fully nine-tenths of the camp's production of $30,000,000 has been in ores of over $30 smelter value per ton average, while $12 ores of favorable composition are now profitably handled by direct custom smelting. It can readily be seen that Alta is essentially a high-grade camp, as compared, for instance, with Bingham. Alta is remarkable among the Utah camps for the occurrence of many varied and rare mineral forms of copper, lead and silver, as well as tungsten, molybdenum and vanadium.

Economic Aspect of the Camp.

The camp has two water-power-driven and thoroughly modern concentrating mills in operation that successfully treat the low-grade ores at very low costs of milling. Alta is notable in its application of water power by mining companies, there being three such power plants in operation, while a fourth one is now under construction and in this regard has advantages of cheap power over other camps.

Smelting rates on the camp's ores are exceptionally low. The first link in the solving of difficulties of transportation has been installed in the five-mile aerial tramway of the Continental company, which has a capacity of twenty tons per hour, and is open for custom traffic for other producers at a saving of 75 cents to $3 per ton in cost to wagon hauling. With the reinstallation of the railroad, which should be consummated by next season, the camp will have as low a tariff rate as Park City and an initial daily production of 500 tons.

The total estimated production of Alta has been to date about 1,000,000 tons of crude ore, most of which paid a wagon-hauling rate of about $7 per ton, while up-freight for many years was $20 per ton.

The present average wagon-hauling rate is from $3.25 to $3.75 per ton on ore from mines to Sandy, or nearest railroad point, and $8 to $10 per ton on up-freight, except the Continental, which, though the most inaccessible mine of the district, pays $2 per ton ore hauling and $5 up-freight, as a result of its operation of the five-mile aerial tram.

From a perusal of the above figures it can be seen that improved transportation means millions of dollars in saving of hauling expense and, likewise, it needs no argument to suggest that there must be vast tonnages of ores in the camp that could not bear wagon-hauling expense, and this is, indeed, the fact.

Alta is today the best field in Utah for the investment of capital.

TURNING AN HONEST NICKEL.

William J. Kelley, leading actor at Proctor's theatre in New York, tells of a well-to-do Chicago real estate owner who went into a hardware store and asked the proprietor for a pound of nails. The small package was made up, and the price, a nickel, handed to the merchant, when the customer asked if the purchase could be sent to his house, which was in a distant part of the city. The merchant assented, and, calling a boy, handed him the parcel with a nickel, and said:

"What!" said the customer, "are you going to give the boy a nickel to take the parcel out?"

"Why certainly," said the merchant; I wouldn't think of asking him to go so far for nothing."

"Well," said the meanest man in Chicago, "if you would just as soon give me my nickel I will take it out my-